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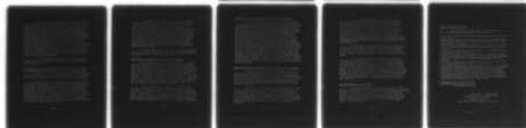
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EUROPEAN SCIENTIFIC NOTES

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CONFERENCE ON SENSITIVE EMULSIONS

An international Conference on Sensitive Emulsions, which took place at the Institute for Astrophysics in Paris September 24-29 under the sponsorship of the French CNRS, brought together over 130 physicists and chemists from all western Europe and East Germany. The persons attending ranged from physicists studying the theory of the solid state with its close connection to the theory of the latent image, to nuclear physicists using emulsions for observing high energy particles. Many chemists interested in latent image formation, sensitisation, and developments were present.

The program presented some 80 papers which may be generally classed under four groups: the theory of conduction processes and reactions in ionic crystals; the theory and behavior of emulsions including the nature of sensitivity centers, the theory of the latent image, and the sensitisation of emulsions; the development process; and the characteristics and technique of nuclear emulsions. A few of the papers in the first and second of these groups will be briefly reported here for their bearing on solid state theory. The complete proceedings of the meeting, including the discussions, will be published in book form by CNRS, 13 Quai D'Orsay, Paris 7, and is expected to appear within a few months.

Photochemical and Photoelectric Observations in Single Crystals

H. Pick of Göttingen discussed the effects of X-rays on crystals. Three types of observations were mentioned; first, a sensitisation of KCl to X-rays by CaCl_2 ; second, the photochemical dissociation produced in KBr single crystals;

and third, the color changes in MgO crystals.

The irradiation of KBr with γ -rays of between 4×10^4 and 3×10^6 e.v. produces violet color centers with a concentration depending on time of irradiation, but approaching a saturation value. Addition of CaCl_2 impurity greatly increases the concentration of color centers obtained from a given exposure, and at the highest concentrations of CaCl_2 , 2×10^{-4} , saturation of coloring is not reached even after 500 hours of exposure. The thermal history also affects the depth of coloring a given crystal can reach.

The photochemical dissociation products in KBr may be detected by the absorption produced in spectral regions where there was previously no absorption. Thus, the F bands correspond to trapped electrons contributed by the potassium atoms while the various V bands correspond to trapped defect electrons (holes) coming from the free halogens; these electrons and holes recombine at a rate depending on temperature. The recombination is observable in the absorption spectrum. In addition to F and V bands, an unexpected band at 201 m μ is found in KBr irradiated at liquid-air temperatures and below. It is believed that this band corresponds to a metastable excitation state of the crystal and not to a dissociation.

The irradiation of single crystals of MgO with X-rays also leads to changes in the absorption spectrum due to photochemical dissociation. The extra absorption has been analyzed exactly into several overlapping bands by preparing crystals in which excesses of the dissociation products, Mg or O, are added separately as impurities. The excess of Mg or of O is produced by diffusion, when the crystal of MgO is held in the vapor at 1200°C.

Surface Conduction Processes in Silver Halides

Oriented single crystals of AgBr or AgCl with optically flat surfaces have been prepared by a special technique by J. Mitchell of Bristol. Two point electrodes with a potential difference of 100 volts applied to the crystal lead to rapid growth of silver threads from cathode to anode along the 100 and 110 directions of the crystal.

The threads are observed under the oil immersion microscope. If polycrystalline specimens are used, the silver threads grow to a grain boundary, spread rapidly along the boundary until near the anode and then move to the anode along the surface.

The crystals are produced by crystallizing from the melt between two optical flats, and the orientation is determined by a seed crystal placed at the edge of the crystallizing melt. The hot sandwich is dropped into cold water and the silver halide crystal retrieved.

Orientated internal silver has also been observed and studied.

Electron Movement and Binding in AgBr Crystals

J. Teltow of Dresden has done experiments on electron movement using silver halide crystals a few mm in size which contain a molecularly dissolved addition of 0.01 mol % of Ag_2S . With these crystals one can study under better defined experimental conditions than with grains in an emulsion, the light absorption, diffusion of electrons and holes, and origin of the latent image. The Ag_2S plays a role similar to that of the sulphur supplied by the gelatine to the grains in the emulsion, and causes an additional optical absorption and a photochemical color change (print-out effect) throughout the volume of the crystal.

The high mobility of holes is easily demonstrated by bringing these crystals into bromine vapor and observing the disappearance of the print-out coloring and of the additional optical absorption, which propagates in a region with a sharp boundary surface inward from the edge of the crystal. The mobility of the diffusing particles calculated from the law of propagation is so great that these particles cannot be bromine atoms, but only holes, which proceed to neutralize the sulphur ions. This high mobility of the holes which must also occur in the primary act of photochemistry is not always considered in the theory of the latent image.

The crystals decolorized by bromine which now contain neutral sulphur atoms, can be restored to their previous state as regards optical absorption and light sensitivity by contact with metallic silver. In this case, electrons

diffuse into the crystal and ionize the sulphur, and again the sharp boundary of the advancing region can be observed, and from its rate the mobility of electrons can be deduced.

The rate of advance of the regions in the above two cases depends on the hole or electron concentrations respectively which depend on the number of lattice defects in the crystal according to the theory of Schottky and Wagner. By introduction of Cd^{++} ions in the lattice, the number of defects is changed (Ag^+ holes increased) and the propagation speed of the region produced by electrons from metallic silver (the second case above) is strongly increased. The converse is true for propagation of the other type region. These results are in agreement with the defect theory and permit evaluation of the concentration of defects.

The Photochemical Reaction Products in Impure Silver Halides

Although it has been shown in the last ten years that only a few light quanta are necessary to make a grain of a photographic emulsion developable, thus indicating the existence of atomic centers for photochemical reactions in silver bromide grains, the direct proof was lacking until recently. This was done in a recent paper by O. Stasiw of Dresden (Zeit. f. Physik, 1951) using mixed crystals of AgBr or AgCl and Ag_2S . The measurements related new absorption bands with such atomic centers, and followed development of the colloid of silver from the atomic center by means of changes in the absorption. To understand these effects, the assumption that both Frenkel and Schottky type defects occur in the crystal is very important.

Further examples of the formation of atomic centers in these mixed crystals have been obtained by Stasiw by irradiation of $\text{AgCl} + \text{Ag}_2\text{S}$ with light at $436\text{m}\mu$ at low temperatures. Absorption bands at $445\text{m}\mu$ and $700\text{m}\mu$ appear whose behavior with temperature and time may be analyzed, using various photochemical reactions involving defects and combinations of defects. The two absorption bands may thus be attributed to specific atomic centers and their behavior understood, e.g., the $700\text{m}\mu$ band corresponds to a complex of a sulphur ion at a chloride ion site with a chloride ion vacancy. The dissociation of this complex when the temperature is raised explains the observed decay of the $700\text{m}\mu$ band. Similar results are obtained with $\text{AgBr} + \text{Ag}_2\text{S}$ crystals.

If the light intensity is weak and the temperature too low (i.e. liquid air) the bands do not arise, but can be produced by increasing the intensity. These experiments are still in progress.

Electron Diffraction Studies of the Growth of Silver in Silver Halides

Thin layers of halide (AgCl, AgBr, AgI) were prepared by D. W. Pashley (Imperial College, London) by evaporation onto various single crystal substrates including MgO, NaCl, KBr and mica. These layers were bombarded by an electron beam of 50kv, and the diffraction pattern of the reflected beam observed. The layer will usually decompose, allowing free silver to form and the manner of its growth may be followed with the diffraction picture. It is found that the silver grows in definite orientations relative to the original crystal, but is not influenced by the orientation of the substrate crystal, hence is characteristic of growth in or on the silver halide.

In AgBr and AgCl most of the silver grows in orientation parallel to the original silver halide, with some twinning or boundary plane formation occurring along [111] directions. Only small amounts of silver are randomly oriented. Decomposition by a chemical developer is found to give completely random orientation, however. When the experiment is done with AgI, most of the silver is found to be random, but a fraction is preferentially oriented.

Similar instability to electron bombardment is found with chemically grown layers if the rate of growth exceeds 10^4 \AA per minute. These layers are formed by the reaction of free halogen vapors on silver. If the rate is slower than this, the layers are stable, as are evaporated layers onto silver substrate, or stripped layers supported on formvar film.

The Primitive Sensitivity of Photographic Emulsions

J. Mitchell of Bristol discussed primary sensitivity on the basis of modern ideas of defects in crystals. The photon striking a grain of AgBr gives rise to an electron and positive hole which then must be trapped at various imperfections in the crystal. These trapping sites are the so-called sensitivity centers which contain the latent image. A large number of possible trapping sites for both electrons

and holes can be suggested and quantitative choice among them is difficult; however, the most favored sites at present are isolated silver ions on the surface for trapping electrons and isolated bromine ions on the surface for trapping holes. The isolated silver ions are present on the internal surface associated with intercrystallite boundaries; the bromine ions are on the external surface only. In addition, there may be silver ions on the external surface located at kink sites of a spiral growth structure, whereas the bromine ions on the surface are free, while the situation is reversed on the internal surfaces.

One effect of the trapping of the electrons and holes at the external and internal surfaces will be the formation of a negative charge on the internal surface and positive charge on the external surface. The formation of the latent image on the internal surface can only continue after these charges have been neutralized by the diffusion of Frenkel defects, interstitial silver ions going to the internal surface and vacant silver lattice sites to the external surface.

DIELECTRICS CONFERENCE AT LIVERPOOL

A Conference on Dielectrics at the University of Liverpool, July 23-25, organized by the Department of Theoretical Physics and directed by Professor H. Fröhlich, brought together over 150 scientists from the United States and western Europe for a review of current research in this field. About 30 papers were contributed by chemists, physicists, and electrical engineers.

Sessions were devoted to work in ferroelectrics, dielectric loss, the relation of dielectric properties and chemical structure, phase transitions, and dielectric breakdown. Of particular interest were the presentation by J. C. Slater of a theory of barium titanate using a simple model; a discussion of the relation between dielectric and elastic properties of a ferroelectric by A. Devonshire; the wealth of dielectric dispersion data on a great variety of materials, over considerable temperature ranges by C. P. Smyth, R. H. Cole, M. Magat, J. Powles, R. Freymann and others; the long review of the phenomena of dielectric breakdown by S. Whitehead; and the theory of directional effects in breakdown by H. Callen. More details of a few of the European contributions follow.

Relation between the Dielectric Properties of a Ferroelectric Ceramic and those of a Single Crystal

A. F. Devonshire (Bristol) discussed the relation between ceramic and single crystal properties of BaTiO_3 . It is necessary to note two kinds of elastic constants, those at constant field, S^E , and those at constant polarization, S^P . In most cases the two constants are nearly the same, but in BaTiO_3 , because of its large dielectric constant, S^E is several times S^P . The elastic constant of the ceramic may be expected to be an average of the single crystal values, since the ceramic is composed of many small randomly oriented crystallites. However, no simple average of the S 's or their inverses (C 's) yields the experimentally determined value of the constant. Thus, $S_{11} = 0.56$ (average over S^P), $= 0.50$ (average over S^E), $= 0.41$ (average over C^P), $= 0.83$ (average over C^E). The experimental value for the ceramic is found to be 0.88.

The same questions arise with respect to the dielectric constant, and both clamped and free constants must be considered. Clamped constants may be measured by using high frequencies and are found to be a factor 2 or 3 less than free constants.

Dielectric Measurements on Potassium Dihydrogen Phosphate

W. Känzig (Zürich) stated that unless one uses a strong biasing field in dielectric constant measurements on ferroelectrics, the observations show the movement of domain walls, as well as the polarization of a single domain, and hence cannot be easily interpreted. Measurements in the presence of a strong biasing field have given the polarization of a single domain of KDP as a function of temperature, and shown that it satisfies the Mueller theory advanced for Rochelle salt. In the absence of a field, the so-called single-domain single crystal is probably composed of regions of alternating polarization. In addition, the difference between the free and clamped dielectric constants predicted by theory has been verified experimentally by the use of high frequencies. The inertia of the material then prevents movement, simulating clamping, but this cannot, of course, prevent the transition at the usual Curie temperature--a point which has not been realized by some workers. $1/\epsilon$ plotted against T gives parallel straight lines for the high frequency and low frequency measurements (Curie-Weiss law), but both show the same Curie point.

Dielectric Loss in Non-Polar Substances

D. H. Whiffen (Birmingham) reported that small residual losses seem always to be observed even in non-polar liquids with highly symmetrical molecules, such as carbon tetrachloride, tetrachlorethylene, carbon disulfide, benzene and cyclohexane. These losses rise in the frequency range above 2 cm^{-1} , and correspond there to a loss tangent of about 10^{-3} . Quantitative examination eliminates various possible sources of loss, such as a rotation mechanism, or the tail of an infra-red absorption band, and makes reasonable a mechanism of distortion of the interatomic bonds in the molecule by interaction with neighboring molecules. Thus, the numerical values for carbon tetrachloride, with dipole moments of the order of 0.1 Debye units, require a distortion of bond angle of about 4° , corresponding to an energy change of 300 cal/mole, which is of the order of the kinetic energy of the molecules at 20°C . The relaxation time corresponding to the collision frequency, is about 10^{-12} secs.

Dielectric Dispersion of Highly Polar Liquids

M. Magat (Paris) discussed measurement of dielectric absorption in water at 0°C . A value of the critical wave-length of 3 cm was found, whereas the corresponding value for ice is 3 km. Since X-rays and Raman spectra show the same local structure in ice and water, it is difficult to account for a frequency difference of 10^5 unless a completely different relaxation mechanism is postulated in the two cases. It is suggested, therefore, that whereas the picture of dielectric dispersion in water should correspond to the formation and disaggregation of a complex between a central molecule and its nearest neighbors, in ice there may be a rotation of the water molecule in its cell or perhaps a displacement of protons.

The dielectric dispersion of hexanol-1, heptanol-1, octanol-1, octanol-2, and deuterium substituted octanol-1 have recently been measured over a frequency range extending to the microwave region, and a temperature range 50°C to 180°C . In all of these, two dispersion regions are found, which shift to lower frequencies in the solid material and as the temperature is decreased. The critical wave-lengths, λ_m , of the primary alcohols, increase monotonically with chain length. A change from OH to OD causes practically no change in λ_m .

Microwave Adsorption due to Adsorbed and Chemically Bound Water

R. Freyman and M. Freyman (Rennes) described dielectric dispersion measurements on free and on adsorbed water. They suggest that the latter may have a "melting point" around -90°C . Observations of the dispersion in the cm wavelength region show losses to persist down to about -90°C in water adsorbed on alumina and silica gel. It is interesting that this "melting point" for adsorbed water falls on the straight line obtained when molecular weight is plotted against the conventional melting point for H_2Te , H_2Se , and H_2S . Low frequency measurements between 1 and 16 kc/sec give similar results for the temperature dependence of a liquid water absorption region. Such dielectric measurements may be useful to distinguish between water of crystallization and adsorbed water, and also between free and bound water in biological systems.

Viscosity and Dielectric Constant in Supercooled Liquids

C. Dodd and G. N. Roberts (Queen Mary College, London) have measured the viscosity of supercooled liquids by a flow method and found a sharp definite break in the viscosity curve at the normal melting point. A plot of \log viscosity against $1/T$ gives two straight lines meeting at the melting point, with a greater rate of decrease of viscosity with (increasing) temperature below the melting point. Measurements have been made on diphenyl ether, chlorobenzene, menthol, and phosphorus. The only non-polar substance examined, gallium, gives no break in the viscosity at the melting point.

Dielectric constant measurements by Mr. Roberts at 100 kc on various polar materials such as diphenyl ether, azoxybenzene, menthol, o-xylene, and p-bromotoluene all give a break in the dielectric constant at the melting point. However, for non-polar molecules (dipole moment less than 0.3 D.u.) such as diphenylmethane, dibenzyl, and p-xylene no break is observed. Tetranitromethane, although it has tetrahedral symmetry, gave a positive result, and appears to have a dipole moment of about 0.5 D.u. as deduced from the amount of loss.

No discontinuity is observed in the density, surface tension, and in preliminary measurements in the ultrasonic absorption.

Dielectric Breakdown in Liquids

Extensive careful measurements on dielectric breakdown in non-conducting liquids such as benzene, hexane, carbon tetrachloride, and saturated hydrocarbons have recently been made by K. MacFadyen (Birmingham) and shown to give reproducible and consistent results. This has been achieved by great precautions with respect to impurities, and surface contamination--clean, highly polished metallic electrode surfaces are required. The slightest film of grease on the electrodes spoils the measurements, and fresh liquid samples, and new electrode surfaces are required each time. Breakdown potentials were measured as a function of time, gap separation, pulse length, temperature, and chain length. A strong correlation is found between the maximum time lag of breakdown and the time required for the positive ion to cross the electrode gap, supporting an ionic mechanism for the breakdown. Thus increasing chain length increases the time delay in proportion to the decrease in mobility. Also, gamma radiation reduces the time lag, and the breaking strength increases with an increasing work function of the metal. It is found that breakdown strength increases as the chain length increases, decreases as temperature increases, and rises sharply for smaller pulse durations. Results free from scatter require short pulse times.

The mechanism of conduction in highly insulating liquids is being reconsidered as a result of this work. The "cumulative ionization" theory may be right after all, and is suggested by the breakdown results. Some measurements have been made, and a crucial experiment will be attempted soon to detect the change in field strength in the dielectric liquid by double refraction measurements.

MUSCULAR CHANGES IN POLIOMYELITIS

Dr. Gunnar Wohlfart of the Department of Neurology, University of Lund, Sweden, has examined microscopically the spinal cord, peripheral nerves, and a large number of muscles of mice inoculated with Theiler's encephalomyelitis ("mouse poliomyelitis"). It is stated that Theiler's disease is in almost all respects analogous to human poliomyelitis. The mice examined represented all stages from the first paralytic day to 200 days afterwards.

Muscle biopsies have been examined from 23 human poliomyelitis cases. These were taken at various times from 1 month to 8 years after the acute stage. A number of muscles have also been studied from 4 autopsy cases of poliomyelitis. Three of them died in the two first weeks, the fourth case about six months after the acute stage. In both Theiler's disease and human poliomyelitis the main muscular changes are of neurogenic origin and secondary to cell changes in the spinal cord. The muscles show a typical picture of "disseminated neurogenic atrophy" as seen in several other diseases in man, for instance amyotrophic lateral sclerosis. In Theiler's encephalomyelitis interstitial and perivascular cell groups are often seen in later stages. There is no histologic evidence of a direct virus attack on the muscles though this possibility cannot be definitely eliminated. Impregnation of intramuscular nerve trunks and end plates during the first paralytic days in Theiler's disease shows pictures of the same type as seen after cutting the muscle nerve.

In late stages an obvious hypertrophy of groups of muscle fibers is seen both in Theiler's disease and in human poliomyelitis.

RADIOACTIVE INDICATORS IN STUDIES OF BLOOD VOLUME AND THE LIFE CYCLE OF BLOOD ELEMENTS

Professor G. de Hevesy of the University of Stockholm has recently reviewed some of the difficulties attached to the use of P^{32} and K^{42} for blood volume determinations.

He prefers the use of thoron (thorium radiation) for such determinations. The technique which he suggests is that a small volume of blood be drawn and exposed to thoron emanations so as to form colloidal radioactive particles within the red blood corpuscles. These remain radioactive for approximately 10 hours. Ninety-seven percent of the radioactivity is found within the red blood cells and three percent in the plasma. An aliquot of the radioactive blood can then be reinjected into a patient. After a suitable time has elapsed to allow for thorough mixing, a second blood sample can be withdrawn and its radioactivity compared with that of the original specimen.

De Hevesy has applied radioactivity techniques to the determination of the length of life of formed blood elements. By injection of radioactive phosphorus, which becomes incorporated into the nuclei of the red blood cells of the chicken, he is able to determine the length of life of such labelled cells. This is determined by the time required for radioactivity to disappear from the blood after a short period of frequent injections of the phosphate and, secondly, by determining the length of time required for all of the red blood corpuscles to become radioactive following a longer period of phosphate injection. He finds that red blood corpuscles of the chicken have a length of life of approximately 30 days, thus confirming the report of Shemin and Rittenberg, who used other techniques.

Similar experiments were done with human leukemic patients in which it was found that the lymphocytes had the surprisingly long life span of 30 days.

VARIATION IN CHROMOSOME NUMBER OF SOMATIC CELLS

R. A. Beatty of the Genetics Department, University of Edinburgh, has found by a study of the literature that the reported chromosome number in human germinal cells was very variable in the years preceding 1930. Since that time, there has been good agreement on the number in humans. There is, however, no such agreement in the chromosome counts of somatic cells which have been reported in the same period. It does not seem probable that improvement in technique since 1930 has been applied to reproductive tissue only. In fact, with the improved techniques of the last 20 years, greater variability in the chromosome number of somatic cells has been found than before.

The historical data Beatty has collected thus points to a real cell-to-cell variation in the number of chromosomes in somatic tissue. He confirms this conclusion in his own studies of their variation in several tissues in mice. The recognition of a normal, high cell-to-cell variability in chromosome number of somatic tissues obviously raises the most basic and far reaching questions concerning the relation of chromosomes to the physiology of development.

EFFECT OF SALICYLATES ON BLOOD SUGAR OF DIABETIC RATS

It has been noted that salicylates reduce blood sugar in diabetics and, possibly because of the similarity in effect on rheumatoid arthritis of salicylates and adrenal steroid hormones, some have thought that this effect on blood sugar of the salicylates was mediated by the adrenal. Drs. J. Bornstein and M. J. Smith at King's College Medical School, London, have demonstrated that the injection of sodium salicylate into alloxan diabetic rats caused an immediate and marked reduction in blood sugar. They were unable to obtain any reduction in the blood sugar by the use of cortisone, chosen as an example of adrenal steroid. Since the excretion of sugar in the urine is also reduced by the injected salicylate, they consider that the reduction in blood sugar must be due to an effect on either its utilization or storage of glycogen in some tissues of the body. The most likely site for storage of this amount of carbohydrate would be the muscle tissue. They have accordingly analyzed the muscle tissue of these rats for glycogen and find that the injection of sodium salicylate does not cause any increase. They are, therefore, directing their attention to the possible effect of sodium salicylate on sugar utilization by muscle tissue of diabetic rats. These studies are now in progress.

GAUZE SWABS FOR DETECTION OF POLIOMYELITIS VIRUS IN SEWERS

During the Second International Poliomyelitis Conference in Copenhagen, September 3-7, MacCallum, of the Central Public Health Laboratory in London, in association with Cockburn, Smithard, and Wright exhibited the techniques which they are now applying to a large scale investigation for the presence of poliomyelitis virus in inter-epidemic periods in some 100 rural and urban communities throughout England and Wales.

Moore (1948) described the use of gauze pads (now known as sewer swabs) for the isolation of pathogenic intestinal bacteria from sewage. Organisms appeared to be concentrated in the swab and were isolated from cultures of the whole swab when a large amount of fluid sewage or even the fluid expressed from the swabs was negative. By placing these swabs in the main and branch sewers it was possible to trace the source of infection back to the house of the carrier.

It was decided to determine whether Moore's sewer swabs were a more convenient and sensitive method for detection of virus as well as bacteria in sewage. Swabs were inserted in inspection traps or sewage mains and left for 72 hours. A litre of liquid sewage was collected at the time of placement of swabs and again at the time of removal. The two samples were then pooled. The raw sewage and fluid expressed from the swabs was treated with 15 percent ether until bacteriologically sterile. A separate pair of monkeys was inoculated intracerebrally with concentrates and intraperitoneally with unconcentrated fluid from the raw sewage and the swabs from each sewer point.

Two comparative studies indicated the merits of the swab. In one, the swabs were positive from the sewer of the house of a case (December, 1950) as was the sewer at the end of the street draining this and 60 other one-family houses. The bulk sewage was positive from the house only.

Another investigation in November 1950 was in a residential nursery which consisted of three blocks containing 160 infants and 60 staff. In one block, A, a case of non-paralytic poliomyelitis had been diagnosed 21 days and the child removed 19 days before the test began, and a paralytic case had been diagnosed 40 days before the test began. In the same grounds was a residential home for 1,000 adults and staff; none of these had had symptoms suggestive of poliomyelitis. Swabs were positive from the sewage from block A and also at a point after this sewage mixed with that from the 1,000 adults. Bulk sewage from both points was negative.

NEW REVIEW JOURNAL IN PHYSICS


A quarterly supplement to the Philosophical Magazine, to be devoted to review articles on advances in physics, has been announced by the publishers, Taylor and Francis, London. The editor, Prof. N. F. Mott, and the editorial board are the same as for the Philosophical Magazine. The first issue is expected in January 1952. Subscriptions in Europe and America will be two pounds fifteen shillings a year, including postage.

TECHNICAL REPORTS OF ONRL

The following reports have been forwarded to
ONR, Washington, since the last issue of ESN:

- ONRL-62-51, "Molecular Spectroscopy Conference in Basel", by
G. J. Szasz
ONRL-72-51, "Some Medical Aspects of the Isotope Techniques
Conference, Oxford, 16-20 July 1951", by Capt. J. P. Wood
and LCdr. W. J. Perry
ONRL-74-51, "The Production of Congenital Anomalies by Vit-
amin B Deficiency and Thyroxin Administration", by G. K.
Smelser
ONRL-75-51, "Recent Cosmic Ray Research at the University of
Manchester", by S. F. Singer
ONRL-77-51, "Problems of Quantum Physics, Copenhagen, Den-
mark, July 6-10, 1951", by S. F. Singer and V. F. Weisskopf
ONRL-78-51, "Symposium on Freezing and Drying", by G. K.
Smelser
ONRL-79-51, "Experimental Studies on the Vertical Migration
of Plankton Animals", by LCdr. W. J. Perry
ONRL-80-51, "The Behavior of Subcutaneous Fat in Lipodystrophy
and Diffuse Symmetrical Lipomatosis", by Capt. J. P. Wood
ONRL-81-51, "Organic Chemical Research at the Chemisches
Institut der Universität, Heidelberg", by S. R. Aspinall
ONRL-82-51, "The Infectious and Contagious Diseases Subject
to Obligatory Reporting in Italy", by LCdr. W. J. Perry
ONRL-83-51, "Nuclear Physics Research at the Universities of
Brussels and Louvain", by Lt. J. K. Beiling

Prepared by the Scientific Staff
Submitted by Dr. Maurice E. Bell
Scientific Director

for 
PHILIP D. LOHMANN
Captain, U.S.N.
Assistant Naval Attache for Research